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literary and other forms of research. The means for beginning this work have been already provided by your honorable board.

It will also be necessary to provide means for fellowships and scholarships. The present writer has been strongly opposed to the present fellowship system in America, believing that its evil of hiring men to study in a certain place often outweighs its advantage of furnishing promising men with means of making the most of their period of training. But in a matter of this kind it is not possible for a single institution to stand aloof from its associates, and to demand an adequate return in laboratory or other assistance from each fellow will tend to minimize these evils of the system.

#### SCIENTIFIC BOOKS

*Anatomy of the Brain and Spinal Cord, with Special Reference to Mechanism and Function.* By HARRIS E. SANTEE, M.D., Ph.D. Fourth edition, revised and enlarged. Philadelphia, P. Blakiston's Son & Co. 1907.

In this fourth edition, Dr. Santee has so enlarged upon the previous editions as to make a book of 451 pages, including an excellent index, and has added a considerable number of illustrations. His confessed endeavor has been to present the present knowledge of the anatomy of the human central nervous system. To do this, he states that he has gleaned, as far as possible, from "original sources" and he gives special credit to the works of McMurrich, Cunningham, Morris's "Anatomy," the reference books of Barker, and to Dr. A. W. Campbell's recent "Histological Studies of Cerebral Localization."

Published in this country, we already have an exhaustive compendium of the literature up to that time, in Barker's "Nervous System" and, in its contemporary, the work of Gordinier, we have a very excellent and serviceable text-book. Dr. Santee's book is less exhaustive as to the anatomy of the nervous system than either of these and one of its

aims is to include added findings which go to make up the present status of our knowledge. It is designed as a text-book for medical students primarily. In the preface it is stated that the special objects in view throughout the book are the "location of functional centers and the tracing of their afferent, associative, and efferent connections." Attention is very wisely given, in the general text, to the embryology when such will aid the student in comprehending the adult structures, and, at the end of the book, a special chapter is wholly devoted to the origin and differentiation of the brain and spinal cord.

In arrangement of subject-matter, the author has presented the structures in the order which he thinks convenient to the dissector, though the book is manifestly for use, not in the dissecting room, but in the laboratory, where properly hardened (and therefore long removed) brains and spinal cords may be used, supplemented with the study of stained sections under magnification. The order begins with the meninges of the encephalon, then passes to the cerebrum and rhombencephalon with their various subdivisions, then takes up the meninges of the spinal cord, followed by a study of the cord itself, and ends with a chapter on the tracing of impulses and the chapter on embryology.

While the dura mater of the base of the cranium almost of necessity has to be studied in the dissecting room, the spinal cord is more easily and safely removed with its dura intact, and usually it is thought that all the membranes are best studied and their significance better grasped while, or after, studying the superficial characters of the structures they envelope. In the study of related mechanisms, it is usually considered pedagogically wisest to proceed from the simpler to the more complex structures. The spinal cord, being much less voluminous and its architecture much more easily grasped, as well as having functional precedence in most of the activities of the general body, is considered first by the student in most laboratories.

In the total 128 illustrations, Dr. Santee has displayed good judgment in the choice of those taken from other works, fifty-three of

these being taken from McMurrich, Gordinier and Morris's "Anatomy" alone. In a few cases, however, the choice is not so fortunate. For example, in Fig. 51, taken from Burbaker, there are four anatomical misrepresentations. Some of the illustrations labeled "original" but little resemble anything found in nature; others of these are strikingly familiar.

The period of transition from the use of the old polyglot nomenclature into that of the BNA is rapidly passing and Dr. Santee has adopted the BNA quite extensively. It would have been amply justifiable and highly commendable had he used the BNA consistently throughout his book, confining himself either to the original Latin terms or to their English equivalents as he preferred. The marked inconsistency with which he uses the nomenclature often gives an impression of crudeness which is unfortunate. In the headings of the paragraphs, often one heading is in the BNA, followed by one or two in the English equivalents of the Latin for no obvious reason, and then may follow a heading in neither the BNA nor its equivalent. Occasionally there is a split use of Latin and English, such as "*columna of the fornix*," "*anterior columna*" (of the spinal cord). The lay-term, "*gray matter*," "*white matter*," is frequently used instead of the much more satisfactory BNA term, *gray substance*; and the gross divisions of the longitudinally running fibers of the spinal cord are referred to as *columus* instead of using the more expressive BNA term *funiculus*, a bundle of bundles (fasciculi). The posterior median sulcus of the spinal cord is given the old misnomer of *fissure* when it does not become a fissure, nor is it so called in the BNA, until the medulla oblongata is reached. On the other hand, certain BNA terms are used which are now quite commonly modified by anatomists; for example, *posterior* and *anterior* instead of the much preferable *dorsal* and *ventral* roots, etc. The term, *cerebral nerves*, might be satisfactorily modified by substituting with the word, *cranial* or *encephalic*, since only four of the twelve pairs, including the questionably typical optic nerves, are attached to the

cerebrum. Also, such terms as "*rubro-spinal tract*," "*relay stations*," and "*excito-reflex fibers*" are crude as well as unsatisfactory, and such an expression as "*Ganglionar Gray Matter of the Cerebellum*" is a rather indefinite way of designating the cerebellar nuclei and smacks of tautology as well, since, strictly speaking, all nervous gray substance is ganglionic and all ganglia are gray substance.

The descriptive anatomy, especially that pertaining to the contours and macroscopic features of the central nervous system, is excellently good and is gone into with considerable detail. The finer microscopic and the functional anatomy can not be so generously accepted throughout. From the nature of the subject, no author can deal with the detailed functional significance of the various structures of the nervous system, especially those of the encephalon, in a way acceptable to all readers.

The description of the neuroglia is wholly that given prior to the year 1895.

For more than twenty years it has seemed to be the ardent desire of practising physicians to divide the prosencephalon into isolated, definitely bounded, functional "*centers*." Dr. Santee has apparently accepted without question a large number of the conclusions with which this literature is filled and states them with a positiveness often more or less unwarranted for the purposes of a text-book. There are given boundary distinctions between questionably separate "*emissive motor centers*" and "*psychic motor centers*," "*receptive common sensory centers*" and "*psychic common sensory centers*," and instead of the more elastic term, *area*, we are given definitely the location in the cerebral cortex of a *speech center*, a *writing center*, a *center of stereognosis*, an *intonation center*, a *naming center*, a *center of abstract concept*, etc. The word *psychic*, qualifying the name of a "*center*," makes it more admissible, for this word may imply any multitude of phenomena whose nature, extent and functional anatomy are not understood. The more conservative works think it wiser to confine definite statements as to cerebral localization of function to those *areas* of the cortex which, by direct

experimental or traumatic stimulation, or by repeated cases of identically similar lesions, are definitely indicated to be concerned with the given functions. The general motor and sensory (somæsthetic) *areas* are known with practical certainty, and experiments have enabled us to subdivide them for different parts of the body; and the areas concerned more than any others with the four special sense organs are generally accepted, though not given definite boundaries. But to go much further, our knowledge will have to advance past the stage, not yet reached, when cerebral tumors may be positively diagnosed both as to existence and especially as to exact position, and when positive interpretations may be made of the varied symptoms accompanying many of the smaller brain lesions.

Further, purely histological studies of cerebral localization are practically worthless as to the existence of "centers." The function of an organ or part of an organ must be previously known, for function can not be inferred from anatomy. With microscopic anatomy especially, one would be more helpless than, for example, he would be with a steam engine or its parts, unknown and seen for the first time. Just as the leaves of a tree are not exactly alike, so are no two gyri, of the same or of different cerebra, exactly alike as to contour, depth of sulci or thickness of pallium. These superficial differences are as marked as internal or structural differences. If analyzed far enough, no two sections of a gyrus will be found identical and, by carefully comparing sections of adjacent gyri, differences of structure are easily distinguishable. All gyri peculiarly situated, and therefore peculiarly shaped, show peculiar structural differences. If a well-defined difference of function of a whole or a part of an organ is positively known, functional significance may then be assumed and attributed to the structural differences, and such assumptions may or may not be correct as the history of the study of many organs shows. Many of the differences in number, size and lamination of the cell bodies, and therefore of the axones, of the various gyri may be more truly explained as due to different intra-

cranial physical conditions present during the processes of growth. The existence of the gyri and their superficial differences are explained in this way.

The execution of the book is fine. The paper is good, the print neat and clear, and the reproduction of the illustrations is excellent.

The intent of a book of this kind is to aid the student in making a more detailed study of the nervous system than is expected with the ordinary text-books of anatomy. Dr. Santee will agree that in making such advanced studies, the student should be urged in every possible way to consult frequently the literature of the subject, yet, no bibliography is given nor is there given an index of authors consulted during the preparation of the book.

IRVING HARDESTY

BERKELEY, CALIFORNIA

*Introduction to Higher Algebra.* By MAXIME BÔCHER, Professor of Mathematics in Harvard University. Prepared for publication with the cooperation of Mr. E. P. R. DUVAL, Instructor in Mathematics in the University of Wisconsin. New York, The Macmillan Company. 1907. Pp. xi + 321.

Analytic geometry is one of the most useful solvents of algebraic difficulties. Among other important solvents of compounds of higher algebra are the group theory, the differential calculus, and the theory of numbers. In the present work analytic geometry is so frequently employed that a good elementary knowledge of this subject is an indispensable prerequisite. Group theory is used very much less frequently and the necessary concepts of this subject are developed very briefly but clearly. The Galois theory of algebraic equations and the explicit theory of congruences are entirely omitted and invariants are treated very briefly. The omission of such important matters seems justified by the title, as it is not intended to be a compendium, but really an introduction to higher algebra.

The reader should, however, not get the impression that he is dealing with a work which is like other so-called higher algebras pub-